LIOPLEURODON ROSSICUS (NOVOZHILOV)—A PLIOSAUR FROM THE LOWER VOLGIAN OF THE MOSCOW BASIN

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ABSTRACT. The species *Pliosaurus rossicus* Novozhilov is redescribed. The short mandibular symphysis places the species in the *Liopleurodon–Stretosaurus* group and the triradiate scapula in the genus *Liopleurodon* itself. The teeth are trihedral in section; hence the material, being specifically distinct from *L. ferox*, is assigned to *L. rossicus*.

IN 1948 Novozhilov described two pliosaurs from the Lower Volgian of the Moscow Basin which he referred to the new species *Pliosaurus rossicus* and *Peloneustes irgisensis*. In the review of Upper Jurassic pliosaurs by Tarlo (1960), it was not possible for me to discuss these species adequately nor assign them to any particular place in the scheme proposed for the other pliosaurs. It was suggested that these two species should be provisionally retained until further description was forthcoming—in particular details of the mandibular symphysis and cervical vertebrae. The reference by Novozhilov of one form to *Peloneustes* was probably due to the false impression culled from the literature that *Pliosaurus* had a short mandibular symphysis. Subsequently Novozhilov (1964) figured the skull and pectoral girdle of *Pliosaurus rossicus* and placed the other species in the new monotypic genus *Strongylokroptaplus*. During my visit to Moscow in 1961 I had an opportunity to examine the type material of *P. rossicus*, thanks to the generous help of Professor C. C. Flerov and Dr. L. P. Tatarinov. Since there is no description available of those parts of the skeleton, which are of prime taxonomic importance, I propose to rectify this omission.

SYSTEMATIC PALAEONTOLOGY

Family PLIOSAURIDAE Seeley 1874
Genus LIOPLEURODON Sauvage

Type species. *Liopleurodon ferox* Sauvage.

Diagnosis. Mandible with short symphysis bearing 5–7 pairs of large caniniform teeth; total of 25–28 teeth in each ramus. Teeth circular in section; trihedral in Kimmeridgian and 'Tithonian' forms. Cervical vertebrae short, length half or less than half width or height. Scapula triradiate with dorsal process directed laterally and ventral plate expanding medially. Epipodials long; short in Kimmeridgian and 'Tithonian' forms.

Liopleurodon rossicus (Novozhilov)

Pliosaurus ? *grandis* Owen; Rozhdestvenski 1947, pp. 197–199, text-figs. 1, 2.
Pliosaurus rossicus Novozhilov 1948, p. 115, fig. 1a.
Pliosaurus rossicus Novozhilov; Tarlo 1960, p. 174.
Pliosaurus rossicus Novozhilov; Novozhilov 1964, p. 331, text-fig. 329.

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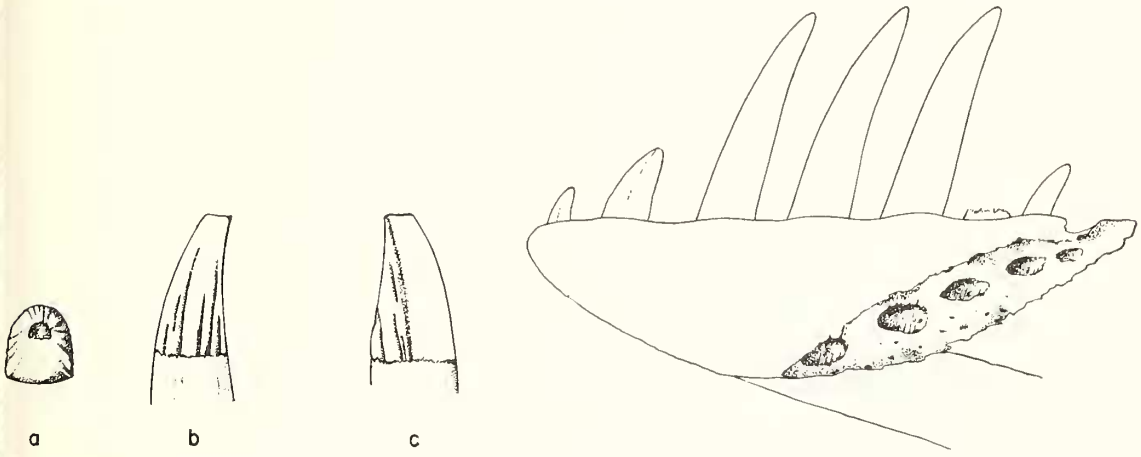
Diagnosis. Teeth trihedral in section, ornamentation of coarse well-spaced ridges on lingual surface, flat and smooth buccally. Epipodials short.

Holotype. Associated skeleton no. 304/1, 1938, housed in the Palaeontological Institute of the Academy of Sciences, Moscow.

Description of Holotype: Skull. The skull was described in detail by Novozhilov (1948, 1964). He noted that the teeth were trihedral in section with the external side smooth as in *Pliosaurus grandis* Owen (= *Stretosaurus macromerus* Phillips). This tooth form appears to characterize all Kimmeridgian and 'Tithonian' pliosaurs (Tarlo 1960); an example is here figured (text-fig. 1). The mandibular symphysis is short, containing only 6 pairs of teeth. The length is 280 mm, width at the fifth tooth 150 mm, and maximum depth (at third tooth) 100 mm. The two anterior pairs of teeth are small but the following three pairs have long crowns with heights of 120 mm 3rd tooth, 125 mm 4th, and over 130 mm 5th tooth. Text-fig. 2 is a sketch of the mandibular symphysis in ventrolateral view.



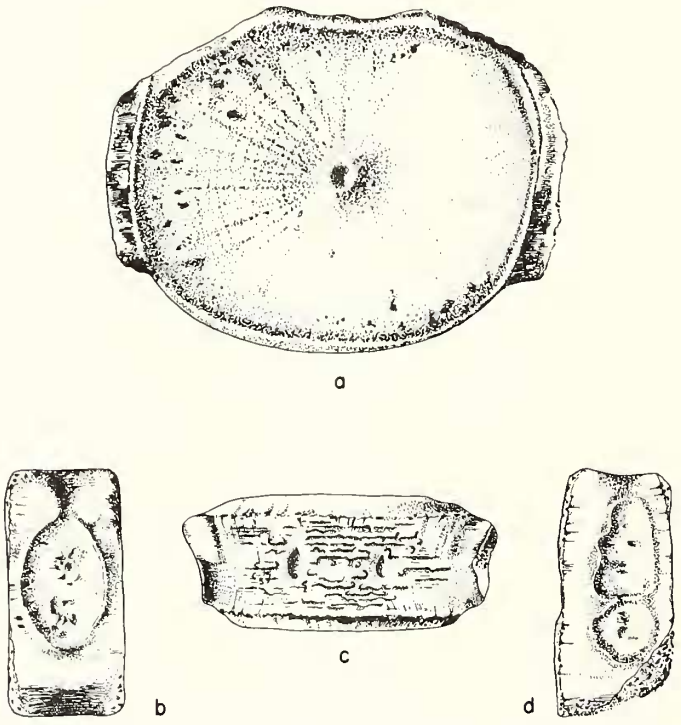
TEXT-FIG. 1. Tooth. *a.* Occlusal view to show trihedral section, *b.* linguo-distal view to show ornament of coarse radial ridges, *c.* bucco-medial view to show smooth flat external surface of crown. $\times\frac{1}{2}$.

TEXT-FIG. 2. Mandibular symphysis in ventro-lateral view. $\times\frac{1}{4}$.

Vertebral column. A number of cervical vertebrae are preserved and measurements, in mm, of a selected number are given in the following table:

	Length	*Height*	*Width at articular surface*	*Number of rib facets*
Cervical vertebrae	36	90	93	2:2
	37	90	96	2:?
	38	95	108	2:2
	39	99	104	2:2
	40	90	100	2:2
Pectoral vertebrae	43	99	110	1:1
	45	102	112	1:1
	47	98	116	1:1

The cervical vertebrae and the pectorals—the last three in the table—are much shorter proportionately than those of the contemporary *Stretosaurus*, but this difference is undoubtedly due to the difference in age of the individuals and hence size. The rib facets seem to be carried higher up the lateral surface of the centra and the single facets of the pectorals have their major axis on the vertical transverse plane, contrasting with *Stretosaurus* where they are aligned obliquely (see Tarlo 1959*b*). The ventral surface of the centrum is devoid of any keel, but instead has a characteristic rugosity reminiscent of that of *Pliosaurus brachyspondylus* Owen (see Tarlo 1959*a*). This is illustrated (text-fig. 3) together with lateral and anterior views of a pectoral vertebra and a lateral view of rib facets of an anterior cervical. In some of the vertebrae there is some evidence of osteophytosis or lipping on the ventral margins of the centra, which suggests that the individual in question was somewhat arthritic.



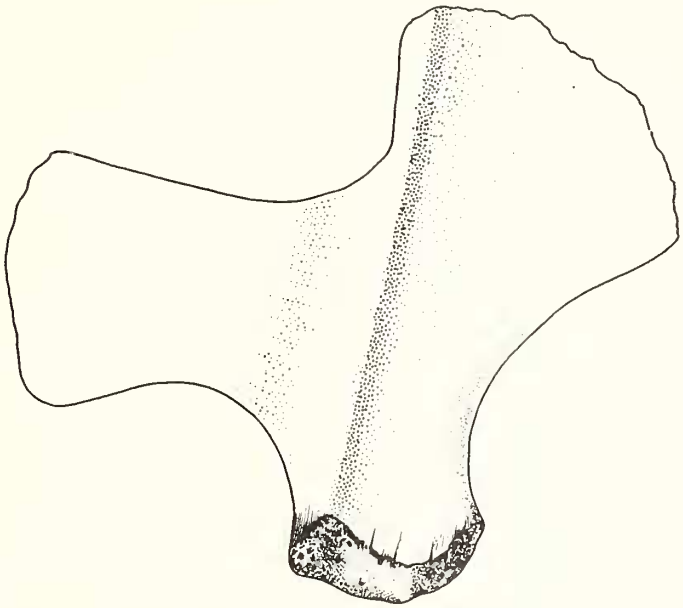
TEXT-FIG. 3. Vertebral centra. *a*. cervical in anterior view, *b*. pectoral in lateral view to show single rib facet, *c*. cervical in ventral view to show characteristic rugosity, *d*. cervical in lateral view to show double rib facet. $\times\frac{1}{2}$.

Pectoral girdle and forelimb. The coracoid and scapula are preserved. The right scapula (text-fig. 4) has a wide dorsal process which is set off from the expanded ventral plate by a small angle forming a ridge on the lateral surface of the bone. The proportions of the dorsal process relative to the ventral plate are very different from those of the scapula of *Pliosaurus* sp. figured by Tarlo (1958). Here again the differences in proportions are

simply due to the size of the individual, and hence its age. The humerus is of normal proportion and its measurements in mm are given in the table below:

	Head		*Mid-shaft*		*Distal end*		*Total*
	width	*thickness*	*width*	*thickness*	*width*	*thickness*	*length*
Humerus	115	130	90	73	200	64	455
Femur	165	160	135	75	240	75	590

The epipodials are short as in all post-Oxfordian pliosaurs.



TEXT-FIG. 4. Right scapula in ventral view showing dorsal set off from ventral plate by ridge. $\times\frac{1}{4}$.

Pelvic girdle and hind limb. The ilium and ischium are preserved as well as the femur and epipodials. The measurements of the femur are given in the above table from which it can be seen that this bone is markedly longer than the humerus but proportionately is more slender, again contrasting with the situation in the giant *Stretosaurus* (Tarlo 1959*b*) The epipodials are short and the girdle bones are comparable to those of other pliosaurs.

Description of '*P.* ? *grandis*'. This specimen consists of a single articulated hind limb and the tip of the snout. The limb is perfectly normal, the femur measuring 820 mm in length. The mandibular symphysis is 450 mm in length but the anterior part is broken, so that in all probability it would have been about 500 mm. There are six pairs of teeth in the symphysis. The 3rd and 5th teeth have a diameter of 60 mm, also they are trihedral in cross-section with a smooth flat outer surface of the crown. The maximum depth of the symphysis is 180 mm and the diameter of the entire snout at the posterior end of the symphysis is 450 mm in width and 500 mm in height.

DISCUSSION

From the above descriptions it is evident that the only differences between the two animals are quantitative. The *P.* '*grandis*' specimen belonged to an individual almost twice the size of the *P. rossicus* specimen. The femora cannot be distinguished. The nature of the mandibular symphyses and the teeth are identical. The teeth merely confirm that the two specimens are of post-Oxfordian age. On the other hand the short mandibular symphysis is characteristic of the *Liopleurodon-Stretosaurus* group of pliosaurs. Previously, the only post-Oxfordian species of this group known was *Stretosaurus macromerus*, which was characterized by its unusual scapula. In all other respects it was similar to *Liopleurodon ferox*. The Russian material under discussion has the same type of scapula as is found in all pliosaurs except *Stretosaurus*; the short mandibular symphysis, however, distinguishes it from *Pliosaurus* itself and thus the species can be referred to the genus *Liopleurodon*. *L. rossicus* differs from the two other species of the genus, *L. ferox* and *L. pachydeirus*, in that the teeth are trihedral in cross section. The ridges on the crowns are reminiscent of *L. ferox* but the flat smooth outer surface clearly separates *L. rossicus* from them, although of course it does not enable this species to be separated from the other post-Oxfordian pliosaurs. The rugose nature of the ventral surface of the cervical vertebrae is a useful feature, but even here great care must be taken not to confuse it with the similar rugosity of *Pliosaurus brachyspondylus*. The significance of the Russian species is that it confirms that the *Liopleurodon* line, as well as giving rise to the unusual *Stretosaurus*, continued without any modification of the pectoral girdle having taken place. Thus the Lower Cretaceous *Kronosaurus* which has a normal pectoral girdle can be readily derived from the Oxfordian *Liopleurodon* without the unfortunate gap in the Kimmeridgian and Tithonian which existed until the Russian form was discovered.

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